science of number and magnitude," "the science which treats of the propertie and relations of quantities," or more briefly, "the science of quantity." Occasional definitions of a more comprehensive character are to be found scattered here and there in mathematical and other writings, but Mr. Kempe doubts whether any of them would satisfy a large body of modern mathematicians; therefore he suggests the following as a provisional definition: "Mathematics is the science by which we investigate those characteristics of any subject-matter of thought which are due to the conception that it consists of a number of differing and non-differing individuals and pluralities." Perhaps this definition will provoke some one to formulate another.

THE playgrounds of our public schools are said to be the arenas in which British battles are fought; and, in a similar sense, we may say that the scientific societies of our colleges are the training schools of scientific investigators. The system of compulsory games tends greatly to limit the time which public schoolboys can devote to natural history or other research, but a few enthusiasts contrive to gratify their curiosity to know something about natural facts and things. The twelfth annual report of the Felsted School Scientific Society testifies to the existence of this spirit of inquiry. Among the papers it contains, we notice one on "The Geology of Felsted," by Mr. J. French, and another on "Recent and Proposed Arctic Exploration," by Mr. J. F. Hartin. The Society used only to be concerned with natural science, but its field of operations has been enlarged, and its usefulness increased, by the creation of a Chemical Section. Stern methods are taken to keep up the attendances at the meetings, for we read: "That any member failing to attend at least one ordinary general meeting in each term in which such meetings are held, without reasonable excuse, be liable to ejection from the Society." It is appalling to think what would be the result of the application of this rule to many learned societies.

A LARGE number of students, as well as persons who do not pretend to possess any special scientific culture, will be glad to know that Tyndall's "Glaciers of the Alps" (Longmans, Green, and Co.), first published nearly six-and-thirty years ago, and for a long time out of print, has been reprinted. Upon Lord Kelvin's advice, no changes have been made in the controversial portions of the book, so the text has been left practically unaltered. Messrs. Kegan Paul and Co. have published a popular edition of Sir John Lubbock's standard work on "Seedlings," reviewed in these columns in January 1893 (vol. xlvii. p. 243). The parts included in the new volume are those of most general interest, and 282 of the 684 illustrations in the original work are used to elucidate the text. A new edition has been published of "Griffin's Electrical Engineers' Price-Book," edited by Mr. H. J. Dowsing. Nearly seventy pages of new matter have been added, and the whole of the prices have been brought up to date. Electrical and other engineers and contractors know that the volume is a ready and trustworthy means of reference to the prices with which they have to deal. The new and improved edition of "Historical and Future Eclipses," by the Rev. S. J. Johnson, just published by Messrs. James Parker and Co., will be appreciated as fully as the original little volume, which came out twenty-one years ago. The book is extremely handy, and contains not only a vast amount of interesting information with regard to eclipses of past and future time, but also notes on planets, double stars, and other celestial matters, thus making it valuable to practical astronomers.

THE additions to the Zoological Society's Gardens during the past week include a Campbell's Monkey (*Cercopithecus campbelli*, ♂) from West Africa, presented by Miss Lilian Frost; two Black-backed Jackals (*Canis mesomelas*), a Puff Adder (*Vipera arietans*) from South Africa, presented by Mr. J. E. Matcham; a Condor (*Sarcorhampus gryphus*) from South America, presented by Mr. C. J. Wedderburn; a Guillemot (*Lomvia troile*), British, presented by Mr. J. L. Palmer; a Moorish Tortoise (*Testudo mauritanica*), from North Africa, presented by Mrs. Powell; a White-crowned Mangabey (*Cercocebus æthiops*, ♀) from West Africa, an Isabelline Lynx (*Felis isabellina*, ♂) from Ladakh, Cashmere, deposited; a Maguari Stork (*Dissura maguari*), a Guira Cuckoo (*Guira piririgua*), a Burrowing Owl (*Speotyto cunicularia*), a Brown Milvago (*Milvago chimango*), a Condor (*Sarcorhamphus gryphus*), a Boa (*Boa constrictor*) from South America, six Mexican Quails (*Callipepla squamata*) from Mexico, a Scarlet Tanager (*Ramphocælus brasilius*), three Scarlet Ibises (*Eudocimus ruber*) from Para, a Ruff (*Machates pugnax*), two Redshanks (*Totanus calidris*), British, purchased.

OUR ASTRONOMICAL COLUMN.

VARIABLE STAR CLUSTERS.—The recent announcement by Prof. Pickering, of the discovery of variability in a large number of stars forming parts of star clusters (NATURE, vol. liii. p. 91), has led Dr. Belopolsky to examine some of the photographs of clusters taken at Pulkowa. Two photographs of the cluster M3 (N.G.C. 5272), in Canes Venatici, were taken in March 1894, and two more in April 1895. In the later photographs one sar was found to be two magnitudes brighter than in 1894, anddiff erences of brightness can also be traced in the case of other stars among the 1800 shown upon the photographs (*Ast. Nach.*, 3338). The Arequipa negatives of the same cluster indicated a variation of brightness in eighty-seven stars, amounting in some cases to at least two magnitudes.

THE SPOTS ON SATURN.—The inability of Prof. Barnard to detect any spots on Saturn with the aid of the Lick telescope may possibly have thrown some doubt upon the existence of such spots. Nevertheless, the observations of them by Mr. Stanley Williams have given such remarkably consistent results, that it is difficult to believe them illusory. In a recent article (*Observatory*, March, p. 112) Mr. Williams points out that there has been some misconception as to the nature of the Saturnian spots and the conditions for their satisfactory observation. While generally admitting the superiority of large telescopes, Mr. Williams holds that the spots on Saturn are such as to require a sight specially trained for their observation. The characteristics of the spots are (1) considerable size, (2) faintness, (3) extreme indefiniteness. The bright equatorial spots average about 2″ in diameter, while the dark spots on the broad double belt in the northern hemisphere have sometimes appeared as large as 4″ long by 2″ or 3″ broad. Similar spots have been noted by other observers, and the estimated positions have been sufficiently accordant to make it probable that the same objects were observed.

The planet will be in opposition on May 5, and it is to be hoped that the spots will receive the attention of observers. The spots appear to be best seen with low powers; with a power of 140 an equatorial spot has been observed to shine with almost stellar brightness, but with higher powers this peculiar brilliancy disappeared. Another point in Mr. Williams' experience is worth putting on record, namely, that in the south of England, at least, definition is usually much better about the time of sunset and for an hour afterwards than at other times.

COMPUTATION OF THE TIMES OF SOLAR ECLIPSES AND OCCULTATIONS.—In the *Revista do Observatorio* (Rio de Janeiro) for 1886, an account was given of a graphical method by which the approximate times of occurrences of solar eclipses and occultations, sufficiently accurate for first approximations, could be determined. Three years later, in a subsequent *Revista*, an application of this method to the eclipse of the sun of December 22, 1889, was made by Mr. Morize, of the Observatory of Rio. With the idea of making this method more general and applicable for all latitudes, the Director of the Observatory, Mr. L. Cruls, has published a short account of the method, simplified both as regards the computations and the graphical construction. The principle is based on the parallactic displacement of the moon in right ascension and polar distance, the values of which

have to be calculated for certain suitable and equidistant intervals of time. Knowing the hourly movements of the moon in right ascension and polar distance for the same instants from the almanack, and the elements of the phenomena, whether it be eclipse or occultation, the tracing of the positions of the bodies may be proceeded with. The plane of the drawing is supposed to represent that plane which is at right angles to the line joining the centre of the moon and the observer, at any one of the chosen instants near the time of conjunction of the two bodies. On this plane the successive projected true and apparent positions of the two bodies, sun and moon, or moon and star, are considered. The line passing through the centres of the moon in her different positions will thus represent the apparent lunar orbit, and if in addition we know the position at the moment of true conjunction of the two bodies, occupied by the centre of the sun or star, according as we are dealing with an eclipse or occultation, it will be easy to find the positions of the centres at the moments of contact, or of immersion and emersion, and also the times.

The calculation of the elements necessary for making the drawing would have for its aim the determination of the co-ordinates of the points of the apparent orbit occupied by the centre of the moon. This work is here rendered very easy by using the series of tables which have been prepared for reducing the calculation to a minimum. As an illustration showing the method of procedure, Mr. Cruls gives two complete worked-out cases, one of the eclipse of the sun at Rio de Janeiro April 16, 1893, and another of the occultation of α Virginis on March 22, 1894, at Greenwich. The accuracy of this graphical method may be gauged from the *observed* minus *calculated* values obtained in the two cases just mentioned.

		m.	
Eclipse of the sun	1st contact ...	−2·4	Observed—Calculated.
	2nd ,, ...	−0·3	
Occultation of α Virginis	Disappearance	+0·8	*Nautical Almanac*—
	Reappearance	+1·2	Graphical Method.

PENDULUM OBSERVATIONS IN GERMANY.

IT is a well-known fact that, at different places on the earth's surface and at the same sea-level, pendulums change their rates of swing. The numerous observations of von Sterneck, made in the region of the Alps, suggested that such deviations from the normal might be, and were most probably, explained on the supposition of unequal distributions of the masses in the neighbourhood—that is, either inside the mountains or in the earth's crust itself. Such observations as these indicated that good work might be done in this direction, and in consequence measurements were made on Mont Blanc, while in other directions observations were being organised by the scientific societies in Vienna, München, Leipzig, and Göttingen. The gravity determinations on Mount Blanc were made at the new observatory, and M. Jannsen informs us that besides those made in Chamounix in the previous summer, and on the Grands Mulets (3050 metres elevation), by M. Bigourdan, an effort will be made to continue them this summer on the summit itself. The results which have been obtained up to the present are as yet unpublished. A region which appeared full of interest for investigating the different rates of swinging pendulums is that in the region of Göttingen and the Harz Mountains. Prof. von Könen singled out what he thought were the three most suitable spots on account of their different geological conditions for such investigations, and observations at these stations were all compared with those made at Göttingen, this being the chief observing station on account of the observatory. It is true that the instrument employed in these determinations was far too rough for accurate and reliable measurements, it being the one which Dr. von Drygalski had previously used on his Greenland expedition, and with which Sterneck made his first experiments. The actual observations were made by Prof. Wilhelm Schur and Dr. Grossmann, and the results were communicated to the *Nachrichten der K. G. der Wiss. Gött.*, Heft 2, 1895. These may be summed up as follows. In the cases of the two stations at Grünenplan and Teichmühle, the very small differences when compared with Göttingen may be neglected when the kind of instrument employed be taken into consideration. The difference for the station Sack, on the other hand, was comparatively large, the numbers being—

For Grünenplan	Sack	Teichmühle
− 0·00018 ...	− 0·00081 ...	− 0·00028

The conclusion drawn by Prof. von Könen from this somewhat rough determination was that the diminution in the intensity of gravity for the station Sack might possibly be due to the present condition of the positions of the underlying superposed strata (Schichtenüberschiebung).

Since the above determinations were made, the same ground has been covered, in September and October last, by Herr Haasemann, who, at the request of Geheimrath Helmert, undertook to make a series of measurements at the same observing stations as used by Prof. Schur. In this new investigation the instruments employed were more accurate and of later design, so that the results may be looked upon as more trustworthy and accurate. Limiting ourselves to giving the actual numerical results, the differences for the three stations when compared as before with Göttingen were—

For Grünenplan	Sack	Teichmühle
+ 0·00007 ...	− 0·00003 ...	− 0·00011

Comparing these figures with those obtained by Prof. Schur, the large difference for Sack entirely disappears. This indicates that at these places the determinations of the rates of the pendulums give no trace of any variation in the intensity of gravity, or at least of any variation which is capable of being detected by the apparatus employed. D.

PETROLEUM LAMP ACCIDENTS.

THE report of Mr. Alfred Spencer, chief officer of the Public Control Department of the London County Council, as to the causes of petroleum lamp accidents, and as to the measures necessary for preventing them, which has just been issued, is an important document. The number of accidents due to the use of cheap and unsafe petroleum lamps has assumed alarming proportions within the past few years, that the means by which the accidents can be prevented cannot be too prominently or too frequently brought before the public. Mr. Spencer has made a thorough investigation with numerous lamps and stoves in which petroleum is used, in order to determine the conditions of safety. The results of his experiments lead him to conclude that raising the flash-point fixed by the Petroleum Acts would not alone be effectual in preventing lamp accidents, as this would not prevent the sale and use for illuminating purposes of oil below that flash-point. He remarks, however, that the prohibition of the retail sale, and the prevention of the use for illuminating purposes of mineral oil below a flashing-point sufficiently high to prevent all lamp accidents, would be effectual if it were practicable. The prohibition by statute of the sale of unsafe lamps would be another means of putting an end to lamp accidents, as both experience and experiment have proved that mineral oils, such as are now in common use, can be safely burnt in properly constructed lamps. The difficulties in the way of prohibiting the sale of unsafe oil are far greater than would be met in regulating the construction and sale of safe lamps; therefore Mr. Spencer suggests that the latter is the means of safety which should be enforced by order of the Secretary of State. His suggestions for the safe construction and proper management of lamps, revised in the light of recent experiments, are as follows:—

CONSTRUCTION.

(1) The oil reservoir should be of strong metal, properly folded and soldered at the joint, and should not be of china, glass, or other fragile material.

(2) There should be no opening between the reservoir and the burner, other than through the tube which holds the wick; and this tube should be extended to within ¼ in. of the bottom of the reservoir, and should have no opening into the reservoir except at its base.

(3) The burner should be securely attached to the reservoir, preferably by means of a strong and well-made screw attachment.

(4) There should be no openings through which oil could flow from the reservoir should the lamp be upset.

(5) Every table lamp should have a broad and heavy base, to which the reservoir should be strongly attached.

WICKS.

(6) Wicks should be soft, and not tightly plaited, and should quite fill the wick-tube without having to be squeezed into it.

(7) Wicks should be frequently renewed, and before being put into lamps should be dried at a fire and then immediately soaked with oil.